IN THE CLAIMS

Complete listing of the claims:

1. (Original) A laser based coordinate measuring device for measuring a position of a remote target, the measuring device comprising:

a stationary portion having at least a first laser radiation source and at least a first optical detector;

a rotatable portion that is rotatable with respect to the stationary portion; ~~and~~

at least a first optical fiber system for optically interconnecting the first laser radiation source and the first optical detector with an emission end of the first optical fiber system, the emission end disposed on the rotatable portion for emitting laser radiation to the remote target and for receiving laser radiation reflected from the remote target, wherein an emission direction of the laser radiation is controlled according to the rotation of the rotatable portion.

2. (Original) The laser based coordinate measuring device according to claim 1, wherein the first optical fiber system includes at least first, second, and third optical fibers and a coupler assembly, the first optical fiber for directing light to the rotatable portion from the laser radiation source, the second optical fiber for directing light from the rotatable portion to the optical detector, and the third optical fiber having the emisison end and coupled to the first and second optical fibers by the coupler assembly.

3. (Original) The laser based coordinate measuring device according to claim 2, wherein the coupler assembly is disposed on one of the rotatable portion and the stationary portion.

4. (Original) The laser based coordinate measuring device according to claim 1, wherein three dimensions of position and three dimensions of orientation corresponding to the remote target are determined.

5. (Original) The laser based coordinate measuring device according to claim 1, further comprising a second laser radiation source disposed on the stationary portion and a second optical fiber system for optically interconnecting the second laser radiation source and the rotatable portion, a wavelength of second laser radiation source being different than a wavelength of the first laser radiation source.

6. (Original) The laser based coordinate measuring device according to claim 5, further comprising a beam combiner disposed on the rotatable portion for receiving and combining laser radiation emitted from the first and second optical fiber systems into a substantially single composite beam.

7. (Original) The laser based coordinate measuring device according to claim 6, wherein the beam combiner includes at least one beam splitter, the laser radiation from one of the first and second optical fiber systems incident from a first side of the beam splitter and being transmitted through the beam splitter, and the laser radiation from the other one of the first and second optical fiber systems incident from a second side of the beam splitter and being reflected off the beam splitter to become combined with the laser radiation from the first optical fiber system transmitted through the beam splitter.

8. (Original) The laser based coordinate measuring device according to claim 7, wherein the laser radiation reflected from the target is incident from the second side of the beam splitter so as to be split into a first portion having the first wavelength that is transmitted through the beam splitter to the first optical fiber system and a second portion having the second wavelength that is reflected to the second optical fiber system.

9. (Original) The laser based coordinate measuring device according to claim 1, further comprising a beam expander to expand the diameter of a beam including the laser radiation from the first optical fiber system.

10. (Original) The laser based coordinate measuring device according to claim 1, wherein the remote target includes a retroreflector.

11. (Original) The laser based coordinate measuring device according to claim 10, further comprising a position detector for detecting a position of the emitted laser radiation relative to the retroreflector.

12. (Original) The laser based coordinate measuring device according to claim 11, further comprising an actuator for controlling the rotation of the rotatable portion in accordance with a result of the position detector.

13. (Original) The laser based coordinate measuring device according to claim 1, further comprising a first motor disposed to rotate the rotatable portion about a first axis, a first angular encoder to measure the rotation of the rotatable portion about the first axis, a second motor disposed to rotate the rotatable portion about a second axis, and a second angular encoder to measure the rotation of the rotatable portion about the first axis, wherein the first and second axes are substantially orthogonal with respect to each other.

14. (Original) The laser based coordinate measuring device according to claim 13, wherein a first portion of the first optical fiber system is disposed along the first axis and a second portion of the first optical fiber system is disposed along the second axis.

15. (Original) The laser based coordinate measuring device according to claim 14, wherein the first portion allows rotation along the first axis without disturbing signals carried by the fiber system and the second portion allows rotation along the second axis without disturbing signals carried by the first optical fiber system.

16. (Original) The laser based coordinate measuring device according to claim 1, wherein the first optical detector is a part of an absolute distance meter.

17. (Original) The laser based coordinate measuring device according to claim 16, further comprising an incremental distance meter.

18. (Original) The laser based coordinate measuring device according to claim 1, wherein the first optical detector is a part of an incremental distance meter.

19. (Original) The laser based coordinate measuring device according to claim 1, further comprising a locator camera to determine an approximate position of the remote target so that the rotatable portion can be oriented to direct the laser radiation to the remote target.

20. (Original) The laser based coordinate measuring device according to claim 1, further comprising an orientation camera to determine the orientation of the remote target.

21. (Original) A laser based coordinate measuring device, comprising:

a rigid structure rotatable about two substantially orthogonal axes;

a laser radiation source disposed off the rigid structure to provide laser radiation;

an optical detector disposed off the rigid structure;

a retroreflective target disposed remote from the rigid structure;

a first optical fiber path optically coupled with the laser radiation source to transmit laser radiation from the laser radiation source to the rigid structure, the first optical fiber path having an end disposed on the rigid structure for emitting the laser radiation to the retroreflective target according to an orientation of the rigid structure and for receiving retroreflected radiation reflected by the retroreflective target; and

an optical coupler optically connecting the optical detector with the first optical fiber path to receive the retroreflected radiation.

22. (Original) The laser tracking system according to claim 21, further comprising a second optical fiber path optically coupled with the first optical fiber path, the second optical fiber path having a reflective end and another end connected to a reference optical detector, wherein a portion of the laser radiation is transmitted from the first optical path to the second optical path to be back-reflected from the reflective end and transmitted to the reference optical detector.

23. (Original) The laser tracking system according to claim 22, wherein the laser radiation and the retroreflected radiation define a measurement path and the laser radiation and the back-reflected radiation define a reference path.

24. (Original) The laser tracking system according to claim 21, further comprising a second optical fiber path for optically connecting the optical coupler with the optical detector.

25. (Original) The laser tracking system according to claim 21, further comprising an isolator disposed in the first optical path to prevent the retroreflected radiation from being transmitted to the laser radiation source.

26. (Original) A laser based coordinate measuring device for measuring a position of a remote target, the measuring device comprising:

a stationary portion having at least a first laser radiation source;

a rotatable portion that is rotatable about first and second axes of rotation with respect to the stationary portion; and

an optical fiber path for optically interconnecting the first laser radiation source with the rotatable portion, wherein a first portion of the optical fiber path is disposed along the first axis and a second portion of the optical fiber path is disposed along the second axis.

27. (Original) The laser based coordinate measuring device according to claim 26, wherein the first and second axes are substantially orthogonal.

28. (Original) The laser based coordinate measuring device according to claim 27, further comprising:

a first motor disposed to rotate the rotatable portion about the first axis;

a first angular encoder to measure the rotation of the rotatable portion about the first axis;

a second motor disposed to rotate the rotatable portion about the second axis; and

a second angular encoder to measure the rotation of the rotatable portion about the first axis.

29. (Original) The laser based coordinate measuring device according to claim 28, further comprising an actuator for actuating the first and second motors to control the rotation of the rotatable portion.

30. (Currently amended) A laser based coordinate measuring device, comprising:

a structure rotatable about two substantially orthogonal axes;

a laser radiation source disposed off the rotatable structure to provide laser radiation;

a retroreflective target disposed remote from the rotatable structure, the retroreflective target having a pattern thereon;

an optical system for directing the laser radiation from the laser radiation source to the rotatable structure and then to the retroreflective target in accordance with the rotation of the rotatable structure, the retroreflective target reflecting the laser radiation to the rotatable structure; and

an orientation camera optically coupled with the reflected laser radiation to determine an orientation of the retroreflective target, the orientation camera including a detector and a lens system that forms an image of the pattern on the detector, wherein the orientation camera is disposed on the rotatable structure.

31. (Original) The laser based coordinate measuring system according to claim 30, wherein the orientation camera has a substantially constant magnification.

32. (Original) The laser based coordinate measuring system according to claim 31, wherein the orientation camera includes an afocal lens system.

33. (Cancelled)

34. (Original) The laser based coordinate measuring system according to claim 30, wherein the orientation camera measures three degrees of orientational freedom.

35. (Original) The laser based coordinate measuring system according to claim 34, wherein the orientation camera determines the pitch, yaw, and roll angles of the retroreflective target.

36. (Original) A laser based coordinate measuring system device, comprising:

a structure rotatable about two substantially orthogonal axes;

a laser radiation source disposed off the rotatable structure to provide laser radiation;

a retroreflective target disposed remote from the rotatable structure;

an optical system for directing the laser radiation from the laser radiation source to the rotatable structure and then to the retroreflective target in accordance with the rotation of the rotatable structure, the retroreflective target reflecting the laser radiation to the rotatable structure; and

an orientation camera disposed on the rotatable structure and optically coupled with the reflected laser radiation to determine three orientational degrees of freedom of the retroreflective target.

37. (Original) A laser based coordinate measuring system, comprising:

a structure rotatable about two substantially orthogonal axes;

a target disposed remote from the rotatable structure;

a locator camera disposed on the rotatable structure for determining an approximate location of the target; and

an actuator system to orient the rotatable structure in accordance with the location determined by the locator camera.

38. (Original) The laser based coordinate measuring device according to claim 37, wherein the locator camera including a plurality of light sources disposed substantially circumferentially about a central point for emitting light and a detector disposed substantially at the central point to receive light reflected from the target and to determine an approximate location of the target.

39. (Original) The laser based coordinate measuring device according to claim 37, further comprising means for launching a laser beam from the rotatable structure, an optical axis defined by the locator camera being substantially orthogonal with an optical axis defined by the lauching means.

40. (Original) A laser based method for measuring coordinates of a remote retroreflective target, comprising the steps of:

coupling laser radiation into a first end of an optical fiber path, the optical fiber path having a second end disposed on a rotatable structure;

controlling the rotation of the rotatable structure to direct the laser radiation to the remote retroreflective target;

coupling a first portion of retroreflected laser radiation with an orientation camera;

coupling a second portion of the retroreflected laser radiation with a distance meter; and

calculating three positional and three orientational degrees of freedom of the remote retroreflective target.

41. (Original) The method according to claim 40, wherein the controlling step includes the steps of rotating the rotatable structure about two substantially orthogonal axes and measuring an amount of rotation about each axis with angular encoders.

42. (Original) The method according to claim 40, further comprising the step of receiving the second portion of the retroreflected light into the second end.